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ABSTRACT

Age-related characteristics of children's short-term retention of kinesthetic movement information were examined in this study. Three age levels (6-, 8-, and 10-year old children) were tested for recall of preselected location movements on a linear slide apparatus. Immediate and delayed recall were used in 16 trials. The results indicate that 6-year old children are less capable of efficient encoding of kinesthetic cues than are 8- and 10-year old children. In the delayed recall tests, 6- and 8-year old children showed a significant increase in response error and variability, while 10-year olds exhibited no change in recall performance. This indicates that 10-year old children are capable of spontaneous undirected memory rehearsal of kinesthetic cues and that younger children may be deficient in central processing or rehearsal strategies for recall of kinesthetic position cues. (FG)

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A DEVELOPMENTAL STUDY OF SHORT-TERM MEMORY CHARACTERISTICS FOR KINESTHETIC MOVEMENT INFORMATION

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RUNNING HEAD: DEVELOPMENTAL MEMORY

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SUMMARY

The present experiment was designed to examine age related characteristics of short-term retention of kinesthetic movement information. There is a considerable body of research evidence in regards to adult motor memory characteristics. This work has consistently shown that coding and retention of joint position information (i.e., location) places demands upon central processing capacity. However, the accuracy and retention characteristics of kinesthetic movement cues has not been extensively examined from a developmental perspective. Ten boys and ten girls each from age groups 6-, 8-, and 10 years (N = 60) were tested for recall of preselected location movements on a linear slide apparatus. Sixteen trials were administered with one-half involving immediate recall and one-half involving a 15-sec unfilled delay interval. The results revealed age X retention interval interactions for all dependent variables (AE, CE, VE). Analysis on AE and VE revealed identical patterns of recall performance. Reproduction of movement position at the immediate interval was significantly less accurate and more variable for the six-year-olds than for the eight-, and ten-year-olds which were not different. Following the 15-sec delay interval there was a significant increase in recall and variability for the six-year-olds and eight-year-olds. However, there was no change in recall performance for the ten-year-olds following the delay interval. Analysis of the age X retention interval interaction for CE revealed a significantly greater positive CE at the immediate interval for the six-year-olds than for the eight-, or ten-year-olds. There was no significant difference between age groups in the pattern

of recall bias following the 15-sec delay interval, with all groups displaying a small positive CE. These results indicate that children as old as eight years of age are still deficient in central processing and/or rehearsal strategies for recall of kinesthetic position cues. Further research is needed to examine different kinesthetic cues as well as the influence of different retention interval lengths and activity conditions.

Researchers from the verbal domain have consistently reported that rehearsal styles and memory recall are related to developmental age (Chi, 1976; Flavel, Beach, and Chinsky, 1966; Haith, 1971). However, limited investigation has taken place to examine the accuracy of recall and pattern of retention for kinesthetic cues from a developmental perspective. Smothergill (1973) suggests that when recall is delayed, young children do not remember movement positions as well as older subjects. It might be argued that older subjects rehearse the encoded kinesthetic information and that younger subjects do not. Kelso, Goodman, Stamm and Hayes (1979) have examined the memory characteristics for kinesthetic information using mentally retarded subjects. Their results indicated that young children could maintain motor information over brief time intervals (7 sec.) but the accuracy began to deteriorate over a 15 second delay interval.

While these two studies were obviously performed with different types of subject populations they nevertheless point out the fact that our knowledge of children's memory performance for kinesthetic information is severely limited. The purpose of this study is to examine age related characteristics of short-term retention of kinesthetic end-location. It is hypothesized that younger subjects will be less effective at rehearsal and maintenance of end-location over a short time delay as compared to older children.

METHOD

SUBJECTS

Subjects for this experiment were children from St. Ann Elementary School in Toledo, Ohio. There were 10 boys and 10 girls each from the age groups 6, 8, 10 years.

APPARATUS AND TASK

The task required the recall of kinesthetic end-location on a linear slide apparatus. Subjects selected their own standard movement (criterion position) on each trial and all trials were performed blindfolded.

PROCEDURE

Following verbal instructions and an opportunity for questions, the subject was given two practice trials. Subjects were given eight trials with immediate recall and eight trials with a 15 second unfilled delay. Each standard movement was followed by the recall attempt with either the immediate or delay interval presented. The experimenter recorded the magnitude and direction of error following each recall attempt. The design of the study was a 3 X 2 (age X retention interval) Anova. Dependent measures were absolute error (AE), variable error (VE), and constant error (CE).

RESULTS

For absolute error (AE) the analysis indicated an age X retention interval interaction ($F_{2, 30} = 9.14$, $P < .01$.). This interaction is displayed in Figure 1. Simple main effects analysis indicated that at the immediate interval the 6 year old group was less accurate than the 8 and 10 year old groups which were not different. Accuracy of recall at the delay interval was significantly different for all three groups with the 6 year olds being least accurate and the 10 year olds exhibiting best accuracy. Analysis across intervals indicated an identical pattern of retention for the 6 and 8 year old groups. For each group, a significant increase in recall error was observed following the 15-second delay interval. However, the 10 year olds were able to maintain recall accuracy with no change following the delay interval.

For constant error (CE) the analysis indicated an age X retention interval interaction ($F_{2, 30} = 5.27$, $P < .05$.). This interaction is displayed in Figure 2. Simple main effects analysis indicated a significantly greater positive CE at the immediate interval for the six-year-olds than that for the eight-, or ten-year-olds. There was no significant difference between age groups in the pattern of recall bias following the 15-second delay interval, with all age groups displaying a small positive CE.

For variable error (VE) the analysis indicated an age X retention interval interaction ($F_{2, 30} = 7.96$, $P < .01$.) This interaction is dis-

played in Figure 3. Simple main effects analysis indicated that at the immediate interval, the 6 year old group was more variable than the 8 and 10 year olds which did not differ. Variability of recall at the delay interval was significantly different for all three groups with the 6 year olds the most variable and the 10 year olds the least variable. Analysis across intervals indicated an identical pattern of retention for the 6 and 8 year old groups. For each group, a significant increase in variability was observed following the delay interval. However, the 10 year olds did not exhibit any increase in response variability following the delay interval.

DISCUSSION

The results of this study indicate that young children (6 years) are less capable of efficient encoding of kinesthetic cues than are 8 and 10 year old children. The results indicate that this younger age group fails to establish a strong memory representation of kinesthetic position information as evidenced by less accurate and more variable recall performance at the immediate retention interval.

The more interesting observation however is that of recall accuracy following an unfilled 15-second delay interval. The results indicate that both the 6 and 8 year old groups exhibited a significant increase in response error and variability while the oldest age group exhibited no change in recall performance. This result indicates that children as old as 8 years of age are still deficient in central processing and/or

rehearsal strategies for recall of kinesthetic position cues. While 10 year olds appear capable of spontaneous undirected memory rehearsal of kinesthetic cues, this was not the case for younger children. Research from the verbal domain has shown that young children (5-8 years) can imporve memory recall following an instructional period in which rehearsal strategies are taught. Similar techniques need to be employed in the study of kinesthetic or motor memory as well as the need to examine recall of different kinesthetic cues, varying retention interval lengths, and different activity conditions.

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AUTHOR NOTE

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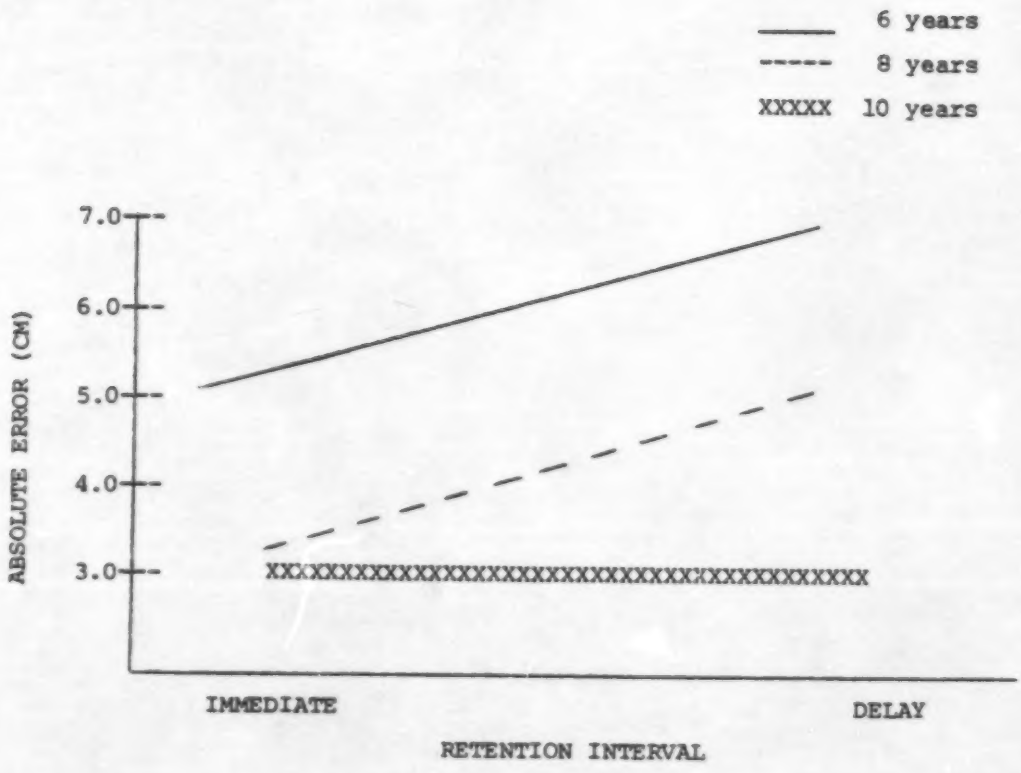
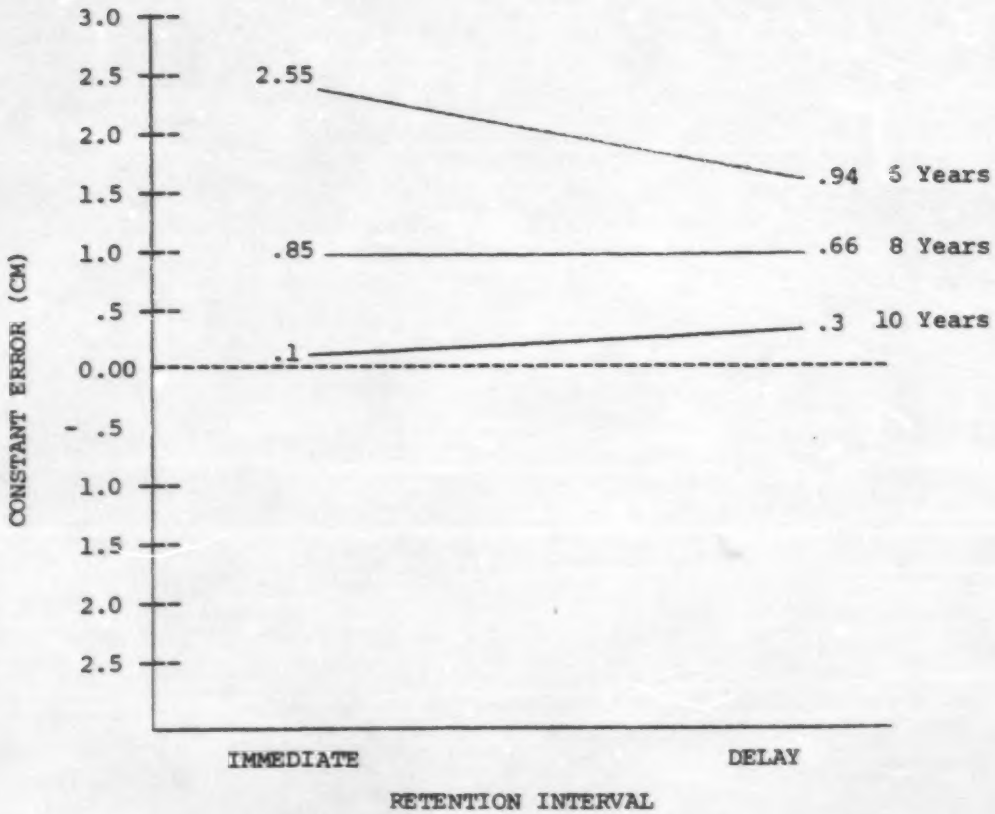
FIGURE CAPTIONS

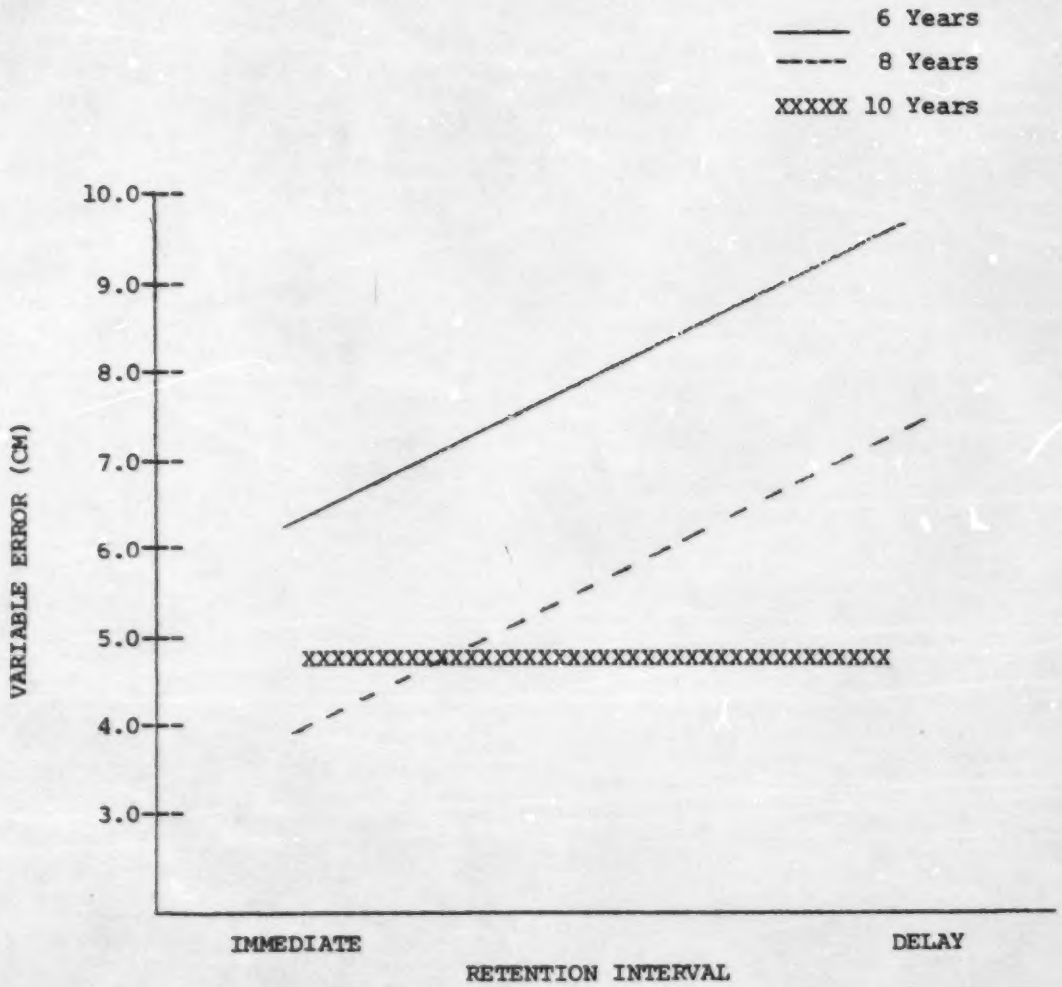
Fig. 1. Mean recall error for age groups and retention intervals.

Fig. 2. Mean recall error for age groups and retention intervals.

Fig. 3. Mean recall error for age groups and retention intervals.


6 years
8 years
10 years
7.0
6.0
5.0
4.0
3.0
ABSOLUTE ERROR (CM)
IMMEDIATE
DELAY
RETENTION INTERVAL


3.0
2.5
2.0
1.5
1.0
.5
0.00
- .5
1.0
1.5
2.0
2.5
CONSTANT ERROR (CM)
2.55
.94
5 Years
.85
.66
8 Years
.1
.3
10 Years
IMMEDIATE
DELAY
RETENTION INTERVAL


6 Years
8 Years
XXXXX 10 Years
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
VARIABLE ERROR (CM)
IMMEDIATE
DELAY
RETENTION INTERVAL